3.2 HYDROLOGY, FLOODPLAINS, AND WATER QUALITY

This section describes the surface water and groundwater in the study area, as well as floodplains. The floodplain information is based on the *SR-22 West Orange County Connection Floodplain Evaluation Report* (December 2000) and the *Floodplain Evaluation Report Reduced Build Alternative Addendum* (December 2000) (Available under separate cover at Caltrans and OCTA)

3.2.1 Surface Water

Orange County has Mediterranean climate (hot and dry summer, and mild winter). The average rainfall is about 33 centimeters (13 inches), occurring mostly between November and March. Orange County began as an agricultural area, but development has overtaken much of the farmland. The soils in Orange County are subject to severe flooding due to the lack of vegetation, and the large percentage of impervious surfaces. When ground surfaces are covered by impervious materials such as pavement, direct absorption of rainfall is prevented, runoff increases, and flooding can occur. The largest surface water resources within the study area are the Santa Ana River, San Gabriel River, and Santiago Creek (see Figure 3.2-1).

A. LOCATION

The study area lies within the Santa Ana Region (Region 8) of the California Regional Water Quality Control Board (RWQCB) jurisdiction. The Santa Ana Region covers 7,300 square kilometers (2,800 square miles), which includes portions of San Bernardino, Riverside, and Orange Counties. The Santa Ana River is one of the region's most significant features. At approximately 121 kilometers (75 miles) long, it is the region's largest river. It provides roughly 70 percent of the total water recharge for the Santa Ana River basin (RWQCB, 1995). The Santa Ana River originates in the San Bernardino Mountains, and then drains by surface streams that flow southwest, entering the Pacific Ocean at Huntington Beach (USGS, 1999). The present channel of the Santa Ana River was established in 1890. Previously, the river changed its course and old maps indicate a variety of channels tracing its path. Flow in the river is regulated by Prado Dam, the Seven Oaks Dam (recently completed), and other flood-control facilities in the river and tributary areas. The Santa Ana River is Orange County Water District's (OCWD's) Main River System. This system includes the portion of the river from just west of Imperial Highway to Ball Road (all north of the study area). The river's unlined channel bottom, consisting of very sandy permeable material, is directly connected to previous alluvial materials that allow for the transfer of water into the underlying aquifers. OCWD also has an Off-River System, which runs parallel to the Main River System and functions in a similar manner (OCWD, 1999).

Santiago Creek empties into the Santa Ana River approximately 490 meters (1,600 feet) downstream from the Bristol Street bridge, south of SR-22. Flow in the creek has been regulated since December 1931 by Santiago Reservoir (Irvine Dam) and since January 1963 by Villa Park flood-control reservoir (Villa Park Dam). It is also affected by intervening gravel pits. In 1969, nearly 15 centimeters (six inches) of rain fell in one day, causing both the Irvine and Villa Park Dam to overflow and severe damage to properties along the creek, including areas within the study area. Heavy rainfall in the winter of 1997/1998 (an El Niño year) has required maximum releases from the reservoir, resulting in the closure of certain areas along the creek, such as parts of Santiago Park, adjacent to SR-22.

B. USE

Beneficial uses describe the ways water can be used for the benefit of people and/or wildlife. Examples of possible beneficial uses include drinking, swimming, industrial and agricultural water supply, as well as the support of fresh and saline aquatic habitats. The Santa Ana (District 8) RWQCB's *Water Quality Control Plan – Santa Ana River Basin* (1995) describes the uses of the waters of the region.[1]

[1] This plan is available at the RWQCB's office, 3737 Main Street, Suite 500, Riverside, CA 92501.

Figure 3.2-1: Major Surface Water Resources

The Santa Ana River has a variety of beneficial uses. Water within the river is used for municipal and domestic supply, such as community, military, and municipal or individual water supply systems. These uses may include, but are not limited to, drinking water supply (RWQCB, 1995). The Santa Ana River is also used for groundwater recharge, which is further discussed below. The river is used for recreational uses as well, both water-contact and non-water-contact recreational uses. (Water-contact recreation includes activities in which contact with the water is likely, such as swimming, water-skiing, or fishing. Non-water-contact recreation involves activities where contact with the water is not likely, such as scenic viewing, photography, etc.) Water contact recreation waters are used for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses may include, but are not limited to, swimming, wading, and fishing. Non-contact water recreation waters are used for recreational activities involving proximity to water, but not normally involving body contact with water where ingestion of water would be reasonably possible. These uses may include, but are not limited to, picnicking, sunbathing, hiking, sightseeing, and aesthetic enjoyment in conjunction with the above activities. It should be noted that many of these activities are not encouraged recreational activities in certain locations. In fact, in some areas, access to the waterbodies is prohibited. The Santa Ana River also has areas of potential wildlife and freshwater habitat, but these do not occur within the project study area.

Although Santiago Creek is not as large as the Santa Ana River, it has similar beneficial uses. The creek's waters are used for municipal and domestic water supply as well as groundwater recharge. There are potential wildlife and warm freshwater habitats, as well as non-contact water recreational uses.

The San Gabriel River runs southerly along the western corporate limits of Seal Beach next to the I-605 freeway. The San Gabriel River is completely lined through the study area and acts mostly as a transport for water to the Pacific Ocean. The San Gabriel River also has areas of potential wildlife and freshwater habitat, but not within the project study area. According to RWQCB, there are no beneficial uses listed for the San Gabriel River in the study area. The Los Alamitos Channel, which runs parallel to the San Gabriel River, is not lined. There are wetland habitats in numerous locations, including within the study area. RWQCB does not list the channel as having any beneficial uses. For further information regarding wetland habitats, see Section 3.4 of this document.

C. QUALITY

The SR-22/West Orange County Connection study area is densely urbanized, resulting in a high proportion of paved surfaces. The San Gabriel River, Santa Ana River, Santiago Creek, and other channels within the study area, handle the runoff from the high amount of paved area in the region to the Pacific Ocean. Water quality of the surface water is dependent on pollutants in the runoff and volume of runoff. The volume of runoff is dependent on weather conditions. Also, pollution may vary depending on how recent the last storm occurred, which could influence the amount of pollution in the runoff. Water samples are taken and analyzed on the Santa Ana River at Imperial Highway and below Prado Dam by OCWD. Annually, RWQCB and OCWD coordinate an effort to sample water around Prado Dam. Water quality is not sampled within the study area (Hintlian, 2000).

The Contractor shall fully conform to the requirements of the Caltrans Statewide National Pollutant Discharge Elimination System (NPDES) Storm Water Permit, Order No 99-06-DWQ, NPDES No. CAS000003, adopted by the State Water Resources Control Board on July 15, 1999. When applicable, the contractor shall also conform to the requirements of the General NPDES Permit for Construction Activities, Order No. 92-08-DWQ, NPDES No. CAS000002, and any subsequent General Permit in effect at the time of construction. These permits regulate storm water and non-storm water discharges associated with year-round construction activities.

3.2.2 Groundwater

In Orange County, groundwater conditions are influenced by natural conditions such as rainfall, outflow from underground reservoirs to the ocean and other basins, and stream inflow. Artificial conditions such as water extraction through wells, and the infusion of imported or treated water to replenish groundwater supplies also influences the basin's groundwater. The elevation of groundwater varies with the amount of pumping and the amount of recharge. Groundwater basins may be recharged naturally through filtrating precipitation, or artificially with imported or reclaimed water. Because groundwater moves through the earth slowly, in most cases a meter or two (a few feet) per year, polluted water is given an opportunity to filter and purify before being used. Artificial recharge with imported water is practiced as a means of offsetting declining groundwater levels and providing storage for use in times of drought.

A. LOCATION

The Orange County groundwater basin underlies the northern half of Orange County, including the study area (see Figure 3.2-2). The entire basin covers an area of approximately 910 square kilometers (350 square miles), bordered by the Coyote and Chino Hills to the north, the Santa Ana Mountains to the northeast, the Pacific Ocean to the southwest, and terminates near the Orange County line to the northwest, where it connects to the Central Basin of Los Angeles.

The California Department of Water Resources divides the Orange County groundwater basin into two primary hydrologic divisions, the Forebay and Pressure areas (see Figure 3.2-2). The boundary of these two areas generally delineates the areas where surface water or shallow groundwater can or cannot move downward in significant quantities to the first producible aquifer. This boundary represents a transition zone where low-permeability clay and silt deposits increasingly occur in near-surface sediments southwest of the boundary.

The Forebay refers to the area of intake or recharge, where the majority of recharge to the basin occurs primarily by direct percolation of Santa Ana River water. The Forebay Area, which encompasses much of the cities of Garden Grove (eastern side), Santa Ana, Orange, and Tustin is characterized by highly permeable sands and gravels with relatively few and discontinuous clay and silt deposits.

The Pressure Area, in a general sense, is defined as the area in the basin where surface water and near-surface groundwater are prevented from percolating in large quantities into the major producible aquifers by clay and silt layers at shallow depths (upper 15 meters [50 feet]). Most of the central and coastal portions of the basin fall within the Pressure Area, including Garden Grove (western half), Westminster, Seal Beach, Rossmoor, and Los Alamitos. Because the principal and deeper aquifers within the Pressure Area are under "confined" conditions (under hydrostatic pressure), the water levels in wells penetrating these aquifers exhibit large seasonal variations in response to pumping.

B. USE

The Santa Ana River is OCWD's Main River System, which is used for groundwater recharge as described above in Section 3.2.1. Beneficial uses for the Lower Santa Ana River Basin groundwater subbasins are: municipal and domestic supply, agricultural supply, industrial service supply, and industrial process supply.

The current population that OCWD serves is just over two million people and is expected to increase by over half a million in the next 23 years. Water demands are expected to rise from about 635 million cubic meters (515,000 acre-feet) per year to 846 million cubic meters (686,000 acre-feet) per year (OCWD, *Engineer's Report,* 1998). OCWD is making a concerted effort to reduce their customers' reliance on imported water by improving the quality and availability of the groundwater in Orange County. To increase local water supplies, OCWD is working to increase

the capacity of its existing recharge facilities, as well as develop more areas where water can be percolated into the underground aquifers (OCWD, *A Tradition of Innovation*, 1998).

C. QUALITY

OCWD regulates groundwater quality be collecting samples from monitoring wells located throughout the county and testing them for organic and inorganic contaminants. Taking regular samples is a preventative measure and ensures consistently high-quality groundwater.

During 1996 and 1997, the OCWD service area had an average of 506 milligrams per liter (0.0805 ounces per gallon) total dissolved solids (TDS). The TDS concentration had an average flow weight of 466 milligrams per liter (0.0741 ounces per gallon) TDS (OCWD, *Engineer's Report*, 1998). Poorer quality water with high organic or mineral content is treated to make it drinkable.

3.2.3 Floodplain

The Federal Emergency Management Agency (FEMA) *Flood Insurance Study for Orange County, California* has identified 100-year flood limits for nine of the eighteen flood control channels that cross the project alignment (see Table 3.2-1).[2] All of the nine existing culverts studied by FEMA passing under the study area freeways fully contain the 100-year flows without flooding the highway. Detailed floodplain maps at each of the crossings are included in Appendix B (June 2000).

Table 3.2-1
ORANGE COUNTY FLOOD CONTROL FACILITIES

Facility (with Orange County System Number)	Included in FEMA Flood Insurance Study
Los Alamitos Channel (C01)	Yes[a]
Katella Storm Channel (C01S05)	No
Kempton Storm Channel (C01S01)	No
Montecito Storm Channel (C01S03)	Yes[a]
Bixby Storm Channel (C01S04)	Yes[a]
Bolsa Chica Channel (C02)	Yes[a]
Federal Storm Channel (C01S06)	Yes[a]
Anaheim-Barber City Channel (C03)	Yes[b]
Bolsa Grande Storm Channel (C04S02)	No
Westminster Channel (C04)	No
Taft Storm Drain (C04P12)	No
Newhope Channel (C05S10)	No
East Garden Grove-Wintersburg Channel (C05)	Yes[b]
Lewis Storm Channel (C05S10)	No
Santa Ana River (E01)	Yes[b]
La Veta Storm Channel (E08P01)	No
El Modena Storm Channel (E08P06)	No
Santiago Creek (E08)	Yes[b]

[a] Approximate methods used for study of floodplain.
[b] Detailed methods used for study of floodplain.

[2] This study is available at Caltrans District 12.

Figure 3.2-2: Groundwater Recharge Basin

Table 3.2-2
FLOOD FLOWS, ELEVATIONS, AND ZONES

Facility (with Orange County System Number)	50-Year Flow	100-Year Flow* (multiple sources, see notes)	100-Year Elevation meters (Feet)	Flood Zone[a]
Los Alamitos Channel (C01)	Not Available	**69 cms** (1,950 cfs)[b]	Per FEMA, flow contained in channel, exact flooding elevation not determined	No elevations established, a limit only
Katella Storm Channel (C01S05)	Not Available	**220 cms** (780 cfs)[b]	Not determined by FEMA or County of Orange PFRD	Not determined by FEMA or County of Orange PFRD
Kempton Storm Channel (C01S01)	Not Available	**8.2 cms** (290 cfs)[b]	Not determined by FEMA or County of Orange PFRD	Not determined by FEMA or County of Orange PFRD
Montecito Storm Channel (C01S03)	Not Available	**18 cms** (640 cfs)[b]	Per FEMA, flow contained in channel, exact flooding elevation not determined	No elevations established, a limit only
Bixby Storm Channel (C01S04)	Not Available	**5.4 cms** (190 cfs)[b]	Per FEMA, flow contained in channel, exact flooding elevation not determined	No elevations established, a limit only
Bolsa Chica Channel (C02)	Not Available	**109 cms** (3,850 cfs)[b]	Per FEMA, flow contained in channel, exact flooding elevation not determined	No elevations established, a limit only
Federal Storm Channel (C01S06)	Not Available	**11 cms** (400 cfs)[b]	Per FEMA, flow contained in channel, exact flooding elevation not determined	No elevations established, a limit only
Anaheim-Barber City Channel (C03)	27 cms (950 cfs)[a]	37 cms (1,300 cfs)[a] **178 cms** (6,300 cfs)[b]	Per FEMA, flow contained in channel, exact flooding elevation not determined	No elevations established, a limit only
Bolsa Grande Storm Channel (C04S02)	Not Available	Not Available	Not determined by FEMA or County of Orange PFRD	Not determined by FEMA or County of Orange PFRD
Westminster Channel (C04)	Not Available	Not Available	Not determined by FEMA or County of Orange PFRD	Not determined by FEMA or County of Orange PFRD
Taft Storm Drain (C04P12)	Not Available	Not Available	Not determined by FEMA or County of Orange PFRD	Not determined by FEMA or County of Orange PFRD
East Garden Grove-Wintersburg Channel (C05)	24 cms (850 cfs)[a]	**34 cms** (1,200 cfs)[a] 28 cms (900 cfs)[b]	Per FEMA, flow contained in channel, exact flooding elevation not determined	No elevations established, a limit only
Newhope Channel (C05S10)	Not Available	Not Available	Not determined by FEMA or County of Orange PFRD	Not determined by FEMA or County of Orange PFRD

Table 3.2-2 (continued)
FLOOD FLOWS, ELEVATIONS, AND ZONES

Facility (with Orange County System Number)	50-Year Flow	100-Year Flow* (multiple sources, see notes)	100-Year Elevation	Flood Zone[a]
Lewis Storm Channel (C05S10)	Not Available	Not Available	Not determined by FEMA or County of Orange PFRD	Not determined by FEMA or County of Orange PFRD
Santa Ana River (E01) (upstream of Santiago Creek)	1,005 cms (35,500 cfs)[c]	1,400 cms (50,000 cfs)[a] 1,190 cms (42,000 cfs)[b] **1,090 cms** (38,500 cfs)[c]	32.38 m (100.22 ft)[a]	No Floodplain Zone
Santa Ana River (E01) (downstream of Santiago Creek)	1,048 cms (37,000 cfs)[c]	1,400 cms (50,000 cfs)[a] 1,190 cms (42,000 cfs)[b] **1,160 cms** (41,000 cfs)[c]	32.22 m (105.71 ft)[a]	No Floodplain Zone
Santiago Creek (E08) (at SR-22)	113 cms (4,000 cfs)[a]	338 cms (12,000 cfs)[a] 183 cms (6,450 cfs)[b] **127 cms** (4,500 cfs)[c]	51 m (168 ft)[a]	No Floodplain Zone
Santiago Creek (E08) (at SR-55)	113 cms (4,000 cfs)[a]	338 cms (12,000 cfs)[a] 183 cms (6,450 cfs)[b] **110 cms** (3900 cfs)[c]	71 m (232 ft)[a]	No Floodplain Zone
La Veta Storm Channel (E08P01)	Not Available	Not Available	Not determined by FEMA or County of Orange PFRD	Not determined by FEMA or County of Orange PFRD
El Modena Storm Channel (E08P06)	Not Available	Not Available	Not determined by FEMA or County of Orange PFRD	Not determined by FEMA or County of Orange PFRD

Sources: [a] FEMA, 1997. [b] Orange County, 1999. [c] USACOE, 1988.
Note: * 100-year flows that should govern design are **indicated in bold**`
cms = cubic meters per second; cfs = cubic feet per second

The Flood Insurance Study for Orange County, California defines the 10-, 50-, 100- and 500-year flood flows for four of the nine creeks studied that cross the project alignment. The FEMA-defined 100-year flows, elevations, and zones for the four waterways studied are defined in Table 3.2-2. Figure 3.2-3 shows all of the flood control channels.

Figure 3.2-3: Flood Control Channels

The Santa Ana River is the largest river in Orange County and connects to the Pacific Ocean well downstream of SR-22. Historically, the Santa Ana River is a source of repeated and devastating flooding in Orange County. The banks of the river have been stabilized by the placement of rock riprap. In many locations, the channel capacity has been increased by the construction of levees protected by riprap material. The U.S. Army Corps of Engineers (USACOE or Corps) completed the Prado Dam, the major flood control structure on the river, in 1941. Within the Santa Ana River floodplain, the County of Orange Public Facilities and Resources Department (PFRD) has channelized several major tributary watercourses to convey local runoff, but this has not materially reduced the 100-year flooding of the Santa Ana River. One flood control improvement recently completed rivals the flood control effectiveness of Prado Dam. This facility is the Seven Oaks Dam on the Santa Ana River in the San Bernardino Mountains. With the completion of the Seven Oaks Dam and lower Santa Ana River channel improvement project elements from Imperial Highway to the Pacific Ocean, the river channel is now capable of containing a 100-year flood as per the Corps letter of September 27, 1999 (see Appendix C). The resulting, greatly reduced flood limits will be limited to runoff from local storms occurring in the coastal plain of Orange County (Figure 3.2-4).

Figure 3.2-4: FEMA Defined Floodplains

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